

REMARKS

Claims 13-28 were pending in this application. By way of this amendment and reply to the Office Action mailed January 29, 2002, claims 13, 19, 20, 24 and 28 have been amended, claims 16 and 27 have been canceled, and new claims 29-33 have been added. Therefore, claims 13-15, 16-26 and 28-33 are presently pending for further consideration.

In the Office Action, claims 19 and 23 were objected to as being of improper dependent form. Contrary to the Examiner's statement, claim 23 does not depend from claim 22 but instead it properly depends from claim 20. As to claim 19, it have been amended to depend from claim 13. Thus, it is submitted that claims 19 and 23 are unobjectionable.

In the Office Action, claims 13-17, 20-21 and 24-28 were rejected under 35 U.S.C. Section 102(e) as being anticipated by U.S. Patent No. 5,564,617 to Degani; and claims 18, 19, 22 and 23 were rejected under 35 U.S.C. Section 103(a) as being unpatentable over Degani. These rejections, to the extent that they may be applied to the presently pending claims, are traversed for at least the reasons given below.

First, Degani does not disclose a plurality of solder bumps but instead it discloses a plurality of solder paste patterns (36) disposed on the joining surface of a substrate in such a manner as to have leveled tops (see column 5, lines 11 to 62 of Degani). Accordingly, the product produced by the process as recited in claim 13 is not anticipated by Degani.

Also, another important feature of the present invention, as recited in claim 13, resides in that the tops of the solder bumps are flattened and leveled in such a way as to make smaller a coplanarity of the solder bumps. In the specification of the present application, the term "solder bump" is used to indicate a thing or element that is formed out of a mass of solder paste by

heating or reflow, such as for example disclosed on page 2, lines 4-9, and as shown in FIG. 15A. In contrast to this, the solder paste pattern (36) of Degani is a mass of solder paste and cannot be equated to the solder bump in the present invention. Claim 13 recites "heating and melting the masses solder paste -- thereby forming the masses of solder paste into solder bumps". This feature is patentably distinct over Degani, since Degani discloses masses of solder paste, which are not the same as solder bumps. Further, the solder paste patterns in Degani are not flattened and leveled so as to make smaller the coplanarity.

For at least the same reasons as provided above with respect to claim 13, claims 20, 24 and 28 are also patentably distinct over Degani.

Also, with respect to claims 24-27, the Office Action asserts that the claimed jig corresponds to element 25 in Degani. This assertion is incorrect. Rather, element 25 of Degani is a squeegee blade. It is noted that element 22 is a stencil that is used to pour solder paste into respective positions on a patterned substrate wafer 32. There is no pressing of the stencil onto tops of the solder paste 24; rather, the solder paste is allowed to flow into the holes 23 of the stencil 22 at predetermined positions on the substrate wafer 32. Thus, claim 25 is patentable for at least this additional reason.

Furthermore, with respect to claim 28, the Office Action asserts that the claimed jig corresponds to elements 13, 14 of Degani. This assertion is incorrect. Rather, element 13 is an unbumped substrate, which has pads 14 that are placed in contact with solder bumps 11. Thus, there is contact between Degani's unbumped substrate 13 and his solder bumps 11, prior to any heating and melting of the solder bumps 11. In the present invention as recited in claim 28, however, the jig is disposed so that a flat surface of the jig is located at a predetermined position above the masses of solder paste. That

way, in a subsequent heating and melting step, the masses of solder paste have their tops brought into contact with the flat surface of the jig. See also new claim 33, which explicitly recites that the flat surface of the jig is not in contact with any of the masses of solder paste, during the step of disposing the jig.

Due to their dependencies, as well as for the specific features recited therein, claims 13-15, 17, 20-21, 24-26, 28 are also patentably distinct over Degani.

New claims 29-33 have been added to recite additional features of the invention that are not believed to be disclosed, taught or suggested by Degani.

Therefore, for the reasons given above, Applicant believes that the present application is now in condition for allowance, and an early indication of allowance is earnestly solicited.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Marked up Rewritten Claims:

13. (Amended) A circuit board produced by the process of:

preparing a substrate having a joining surface;

disposing [forming] a plurality of masses of solder paste on the joining surface of the substrate;

heating and melting the masses of solder paste, thereby forming the masses of solder paste into a plurality of solder bumps on the joining surface of the substrate; and

flattening and levelling tops of the solder bumps, thereby making smaller a coplanarity of the solder bumps.

19. (Amended) A circuit board according to claim 13 [18], wherein circular pads are interposed between the respective solder bumps and the substrate, the tops of the solder bumps are nearly equal in diameter to the pads, and the height of the solder bumps is smaller than the diameter of the pads.

20. (Amended) A circuit board produced by the process of:

preparing a substrate having a joining surface;

disposing a plurality of masses of solder paste on the joining surface of the substrate;

disposing a jig so that a flat surface of the jig is located at a predetermined position above the masses of solder paste; and

heating and melting the masses of solder paste to bring tops of the masses of solder paste into contact with the flat surface of the jig, [and] thereby forming the masses of solder paste into solder bumps having [flattened

and levelled] tops that are flattened and leveled in such a way as to make smaller a coplanarity of the solder bumps.

24. (Amended) A method of producing a circuit board comprising:
preparing a substrate having a joining surface;
disposing [forming] a plurality of masses of solder [bumps] paste on the joining surface of the substrate;
heating and melting the masses of solder paste, thereby forming the masses of solder paste into a plurality of solder bumps on the joining surface of the substrate; and
flattening and levelling tops of the solder bumps, thereby making smaller a coplanarity of the solder bumps.

28. (Amended) A method of producing a circuit board comprising:
preparing a substrate having a joining surface;
disposing a plurality of masses of solder paste on the joining surface of the substrate;
disposing a jig so that a flat surface of the jig is located at a predetermined position above the masses of solder paste; and
heating and melting the masses of solder paste to bring tops of the masses of solder paste into contact with the flat surface of the jig, [and] thereby forming the masses of solder paste into solder bumps having [flattened and leveled] tops that are flattened and leveled in such a way as to make smaller a coplanarity of the solder bumps.